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Letters Response

Anthropocene Park? No alternative

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Vilà and Hulme [1] and Webber *et al.* [2] raise several issues about translocation as a conservation strategy [3], in the context of climate change. Climate change is likely to be on a par with other threats, and possibly the greatest threat, during the 21st century [4–7], even if it was not the greatest cause of extinctions in the 19th and 20th centuries [1]. I agree that we need integrated approaches that consider the combined impacts of climate and other pressures [1], and that 'relatively' unmodified habitats should remain the key focus for biodiversity conservation [8,9]. These will remain key places for both *in situ* and *trans situ* conservation.

Vilà and Hulme's [1] 'Jurassic Park' title resonates with the core of my argument, that we cannot go backwards. Given that every habitat in the world is to some extent affected by human activities [3], we already inhabit an Anthropocene Park, within which every action we take or decide not to take (including the control of greenhouse gas emissions) has consequences. Vilà and Hulme [1] and Webber *et al.* [2] clearly think that translocation is generally an action that we should decide not to take; I have already laid out my arguments for the circumstances under which translocations might be used as a means of saving species from extinction [2]. Webber *et al.* [2] suggest that *ex situ* conservation would be better; but this is only realistic if we store most endangered species in seed banks and frozen zoos. Once frozen, how will future generations decide when and where to bring them back? How will they assess the risks in restoring them to ecosystems that no longer contain them, and where the environment has continued to change since the day of their incarceration? Restoring thousands of species after 200 or more years on ice does not seem realistic.

Vilà and Hulme and Webber *et al.* also suggest that society would be reluctant to undertake such initiatives, using terms such as 'environmental or social harm' [2] and 'scant appreciation of the cultural as well as scientific value of native biodiversity' [1]. An underlying sentiment is that change is equivalent to harm, and that active translocation of endangered species will be the main cause of change. It won't be. I agree that societal views will generate constraints, but opinions are liable to change. The recent re-establishment of beavers in Britain (and many other European countries) would have seemed completely out of the question only 40 years ago. Attitudes change in the fullness of time, and UK public opinion might well endorse other translocations that aim to help save species from extinction, promote wildlife tourism and 'put right' some of the damage caused by UK greenhouse gas emissions.

Vilà and Hulme [1] question the sense of concentrating on introducing top predators, and specifically on introducing the endangered Iberian lynx, *Lynx pardinus*, to Britain. I did not emphasise top carnivores any more than other types of species (plants and insects): I did not personally select the TREE journal cover to be an image of a lynx; I emphasised to the media (who emphasised lynx and Imperial eagle) that translocation programmes would predominantly involve non-pest plants, specialist insects and other invertebrates; and I did not choose to write a high proportion of my original article about the lynx (whereas Vilà and Hulme [1] did, in their reply). It is others who are putting the furry carnivore spin on this. And I disagree entirely with Webber *et al.* that translocation will only be an option for ecological generalists [2] – Iberian lynx are rabbit specialists, and narrow serpentine endemics that cannot cross non-serpentine soil types would be further prime candidates for translocation.

Note that the species listed in my Box 1 [3] are ones that 'could be considered for translocation', not a list of species that will necessarily be found suitable for translocation, once this consideration has taken place. Webber *et al.* [2] would argue that few combinations or species and recipient locations will be found compatible, after consideration. OK, but let that consideration take place. If, say, 10% of the species threatened with extinction by climate change could be saved by translocation, that might amount to saving more than 1% of the world's species. It is entirely possible that Iberian lynx might be considered unsuitable or unnecessary for translocation [1], although I do not personally think that this is an inevitable conclusion. Iberian lynx is an example of a species for which original endangerment

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was not caused by climate change but which, under climate change, might now find that some of the best potential sites to save it are outside its most recently recorded, historical distribution. At a time when there is discussion of re-introducing the larger and far less endangered *Lynx lynx* to Britain [10], as part of a re-wilding strategy, it is at least worth asking whether the same resources might be better spent on *Lynx pardinus*.

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Letters

Problems formalising the concept of importance in ecology

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In a recent paper in *TREE*, Kikvidze *et al.* [1] highlight the concept of 'importance' in competition research, with special reference to an index (C_{imp}) that they have previously advocated [2–4]. They propose a 'formalised concept of importance' for use in a range of areas of ecology. In this note we wish to make three points: (i) as we have previously argued, C_{imp} is a flawed index of competition; (ii) Kikvidze *et al*. dismiss previous measures of competition as 'binary tests', when they are not; and (iii) the question of 'importance' of competition depends on the context, and the measure used should be driven by the question asked. We conclude that the drawbacks of this approach for studying plant competition are a salutary lesson not to rely on heuristic indices.

The index C_{imp} is defined as:

$$C_{imp} = \frac{(w_m - w_C)}{w_m} \frac{w_m}{(w_{\max} - w_C)} = \frac{w_m - w_C}{w_{\max} - w_C} \quad (1)$$

where w_C is the mean weight per plant in a given environment in the presence of competitors; w_m is the weight of a plant in that environment in the absence of competition; and $w_{\max}$ is the maximum performance in the absence of competitors in 'optimal' conditions. The index is intended to measure the effects of competition along a gradient, relative to the performance in the 'optimal' habitat. As we have pointed out previously, the index says little about competition because, assuming that plants subject to competition are much smaller those grown alone, the index reduces to:

$$C_{imp} \approx \frac{w_m}{w_{\max}} \quad (2)$$

C_{imp} fails as a measure of competition because equation (2) does not actually include the performance of plants subject to competition.

The consequence is that the index is unsuited for measuring the effects of competition along a gradient. It is constrained to have a value of 0 at the 'worst' end of the gradient (i.e. where conditions are so poor that plants cannot grow), and a value of unity at the 'optimal' end (where $w_m = w_{\max}$). Because of this constraint, irrespective of any underlying effect of productivity on competition, a positive relationship between C_{imp} and performance or productivity is highly likely.

We derived equation (2) previously [5] but Kikvidze and colleagues [1,4] have failed to appreciate its significance. Moreover, we showed that C_{imp} converges on a population dynamic interpretation of the variation in competitive intensity only when (i) competition solely affects plant growth; (ii) measured at equilibrium in a natural community; and (iii) no other population parameters (e.g. germination and survival) or interactions (e.g. competition for microsites, and facilitation) vary between environments. Our conclusion was that this renders it unlikely that C_{imp} can provide a useful interpretation in real communities. Kikvidze *et al*. therefore incorrectly cite us as supporting a population dynamic justification of C_{imp} in Box 1 of their paper.

One of the reasons given by Kikvidze *et al*. for promoting C_{imp} is that previous approaches are dismissed as 'binary', simply stating whether competition is important or not.

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